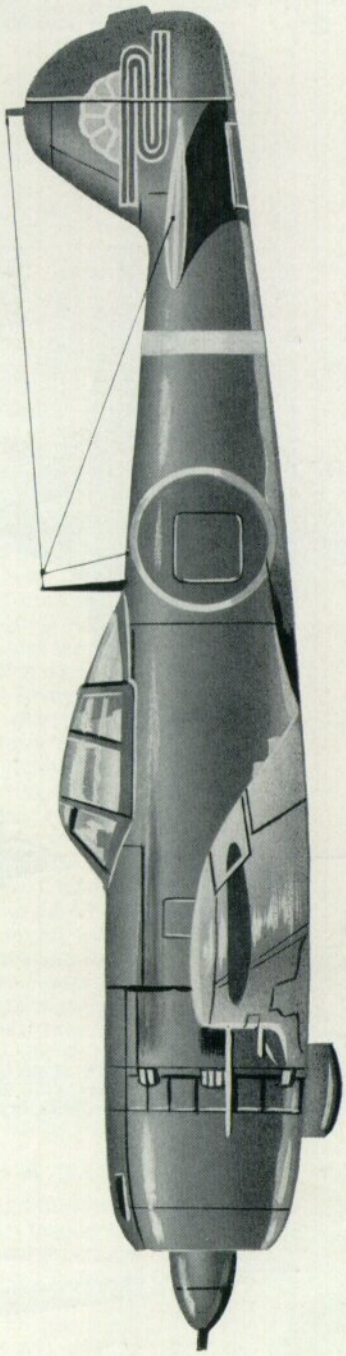
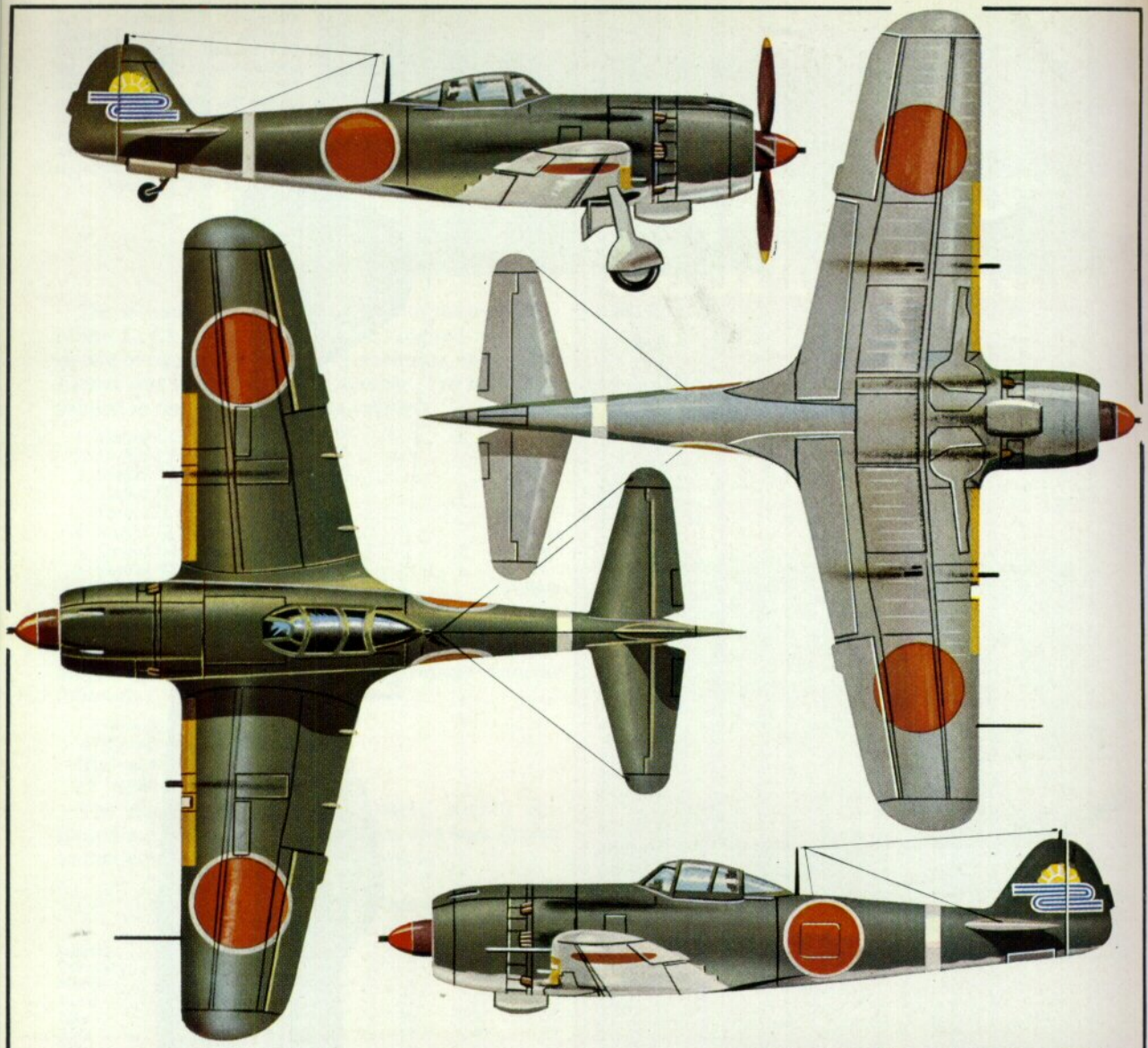
PROFILE
PUBLICATIONS

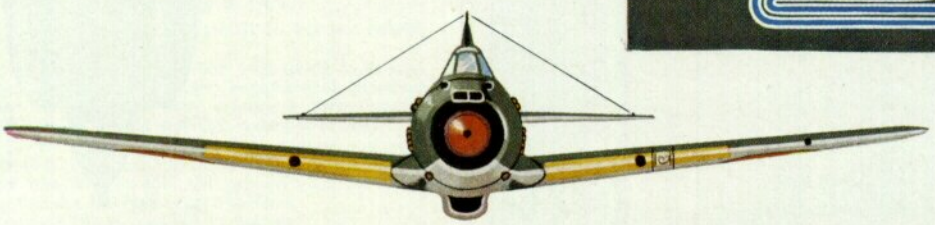
The Nakajima Ki-84



NUMBER 70
TWO SHILLINGS



NAKAJIMA KI-84-Ia, HAYATE of the 22nd Fighter Group (Sentai), H.Q. Flight (Hombu Sentai). This aircraft was based at Hankow, China, in August 1944.



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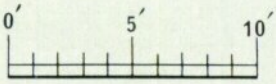
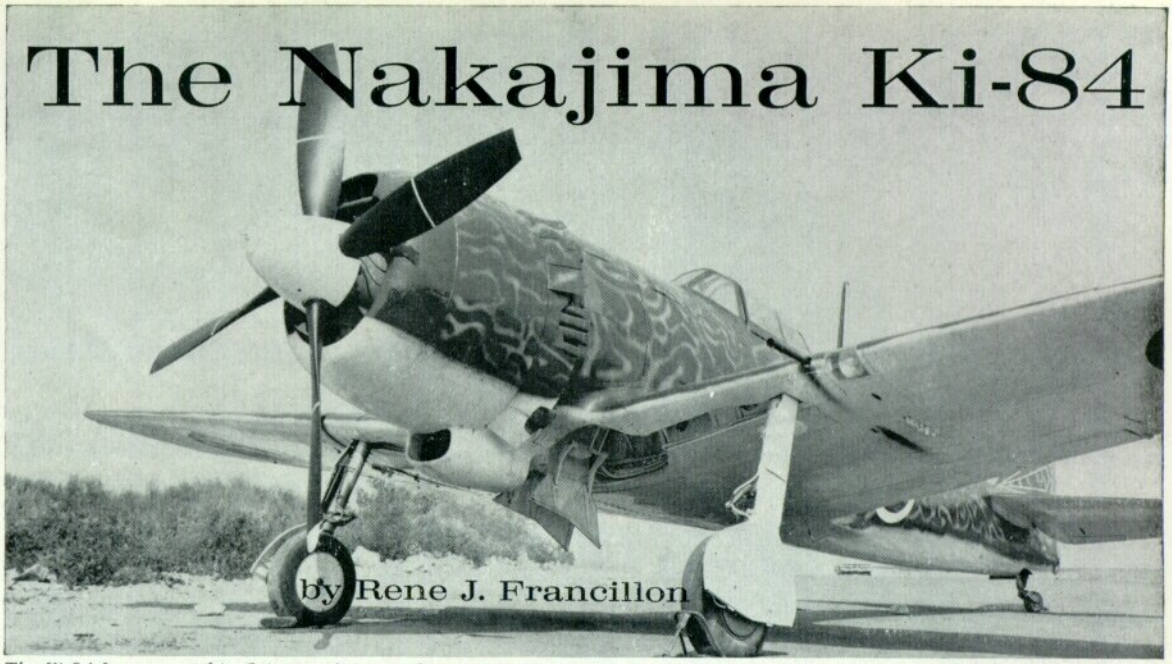


The Nakajima Ki-84



by Rene J. Francillon

The Ki-84-Ia preserved in flying condition at the Air Museum, Ontario, California. Undercarriage and cowling detail can be clearly seen. (Photo: Air Museum)

When war broke out in the Pacific, the Imperial Japanese Army Air Force first-line single-seat fighter units were equipped mainly with the obsolescent Army Type 97 Fighter, the Nakajima Ki-27 "Nate". The Army Type 1 Fighter, Nakajima Ki-43 "Oscar",* had just entered service with two Sentais; and it was to remain the backbone of the JAAF fighter force for at least three years. In 1941 a specialised heavy fighter known to the Allies as "Tojo", the Nakajima Ki-44 or Army Type 2 Fighter, entered operational service, and was followed eighteen months later by the Army Type 3, Kawasaki Ki-61 "Tony", the only Japanese fighter powered by a liquid-cooled engine to see combat. Second-line units continued to employ the obsolete Army Type 95 Kawasaki Ki-10 "Perry" biplane for a considerable period after the outbreak of hostilities.

By the spring of 1944, the Allied Air Forces had won complete air superiority over virtually all fronts of the Pacific theatre; the "Oscars", "Tojos" and "Tonys" were no match for the P-38s, P-51s, F4U-1s, F6Fs and Spitfire F. Mk. VIIIs which now operated under conditions of technical and numerical superiority throughout the area. The Japanese Navy air component relied exclusively upon various sub-types of the Mitsubishi A6M "Zeke"; and by this stage of the war that once-dreaded scourge had shown itself all too vulnerable when pitted against the latest products of Western design. In their endeavours to regain control of the sky the two services adopted widely divergent approaches. The JNAF pursued its policy of developing existing types, while the JAAF pressed on with the production of new designs, a course of action which paid off handsomely with the introduction of a completely new general-purpose fighter, the Army Type 4 or Nakajima Ki-84 *Hayate*.

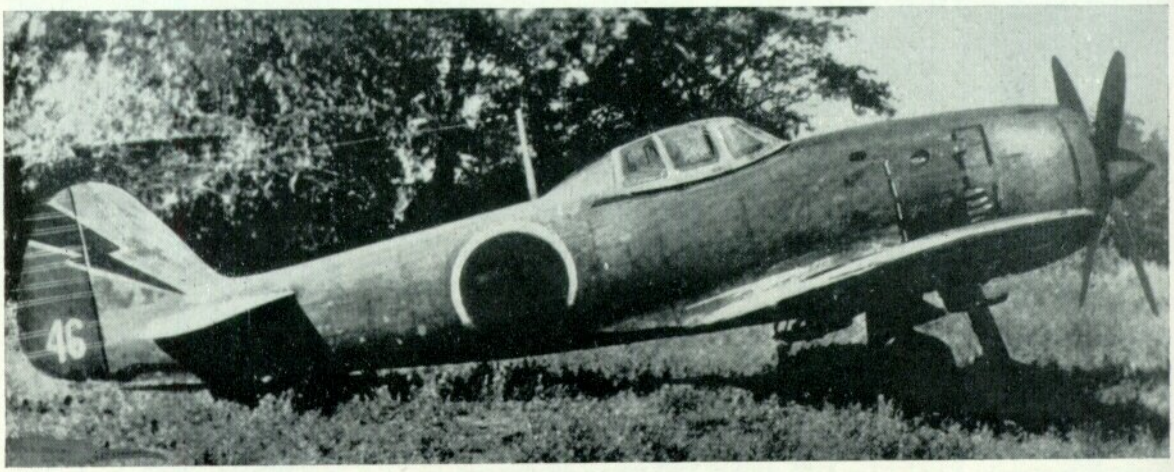
In August 1944, the U.S. Fourteenth Air Force suddenly encountered over China a new fighter aircraft the performance of which far exceeded anything the Japanese had yet been able to throw into battle, and which even outclassed those of the American fighters. This outstanding aircraft was the *Hayate* of the 22nd Fighter Sentai operating out of Hankow. The 22nd Sentai was formed in Japan in late March 1944 as the first operational squadron to be equipped with the new Army Type 4 Fighter *Hayate* (Gale). Its pilots were drawn mainly from the experimental Fighter Chutai which had been formed in the autumn of 1943 to conduct the Ki-84's service trials while other pilots were especially selected for this crack unit because of their previous combat experience. Following four months of intensive training in the Japanese homeland the 22nd Sentai, led by Major Iwahashi, moved out to China where it quickly proved the wisdom of the JAAF policy and although no more than thirty aircraft were available at any one time, it helped the Japanese to regain the offensive. However after only five weeks of operations in Chinese skies, the 22nd Sentai was moved back to Japan en route to the Philippines where the impending Allied invasion had rendered the situation critical for the Japanese. Following the Japanese defeat in the Philippines, the 22nd Sentai was sent once again to Japan and it was operating in Korea when the war ended.

A GALE IS BORN

When the magnificent German liquid-cooled Daimler-Benz DB 601A engine became available to the Japanese aircraft manufacturers Nakajima established a new design team under the leadership of T. Koyama to develop, in competition with the Kawasaki Ki-61, a fighter to be powered by a 1,175-h.p. Kawasaki Ha-40, a DB 601 adapted for Japanese production techniques. The development of this aircraft, known as the Ki-62 under the JAAF designation system, and of a slightly modified version, the Ki-63, powered by a 14-cylinder radial engine Mitsubishi Ha-102 occupied most of 1941; but these aircraft were abandoned before completion in favour of the Kawasaki Ki-61

*See *Profile* No. 46, *The Nakajima Ki-43 Hayabusa.*

One of the pre-production batch Ki-84s, completed and tested between August 1943 and March 1944. (Photo: R. Ward collection)



An Army Type 4 Model Ia Hayate *of the 2nd Chutai, 11th Sentai, which operated from Leyte in the latter part of 1944.*
(Photo: via the author)

due to that firm's greater experience with liquid-cooled engines and to Nakajima's heavy commitments with the Ki-43 *Hayabusa* and Ki-44 *Shoki*. But the experience gained by T. Koyama's team was too valuable to be lost and three weeks after the Pearl Harbour attack, the JAAF discussed with Nakajima a potential replacement for that company's Ki-43. The new aircraft was conceived as an all-purpose, long-range fighter capable of surpassing the best Western aircraft known to be under development at that time. The JAAF requirements regarding manœuvrability were somewhat relaxed when compared to those of the Ki-43 but still exceeded those of the Ki-44, a bomber destroyer-interceptor, as the aircraft was mainly intended for fighter versus fighter combat. Maximum speed was specified at 400 m.p.h.–425 m.p.h. at 16,405 ft. and the aircraft was to operate at combat rating for 1·5 hours at 250 miles from its base. Power was to be supplied by a new 18-cylinder radial engine, the Nakajima Ha-45, and the specified armament comprised two 12·7-mm. Ho-103 machine guns and two 20-mm. Ho-5 cannons. Provision for armour protection and self-sealing fuel tanks was also mandatory.

Drawing heavily on design features of the Ki-62, T. Koyama and his team initiated work on the Ki-84 in early 1942 at Nakajima's Ota plant in Gumma Prefecture. Due to the experience acquired in the previous year work progressed rapidly and the first prototype (No. *8401*) was rolled out in secrecy in late March 1943, flying for the first time at Ojima airfield the following month. A second prototype (No. *8402*) joined the test programme in August of the same year. These two aircraft were powered by a 1,800-h.p.

Ki-84s and Ki-115s in production at Nakajima's Ota plant.

A Shotai (section) of three Ki-84-Ia Hayates *taking off for a sortie during the Philippine campaign of 1944; note drop tanks. The machines illustrated flew with the 1st Chutai of the 52nd Sentai.*
(Photo: via the author)

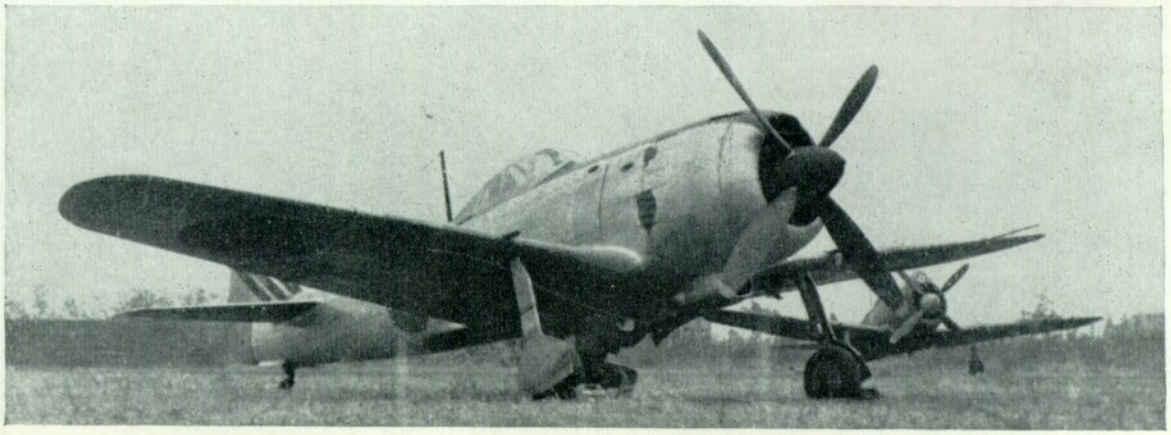
Nakajima Ha-45-11 and were externally distinguished by a big exhaust collector pipe on each side of the engine cowling, the single drop-tank under the fuselage centre-line and the protruding muzzles of the two engine-mounted machine guns.

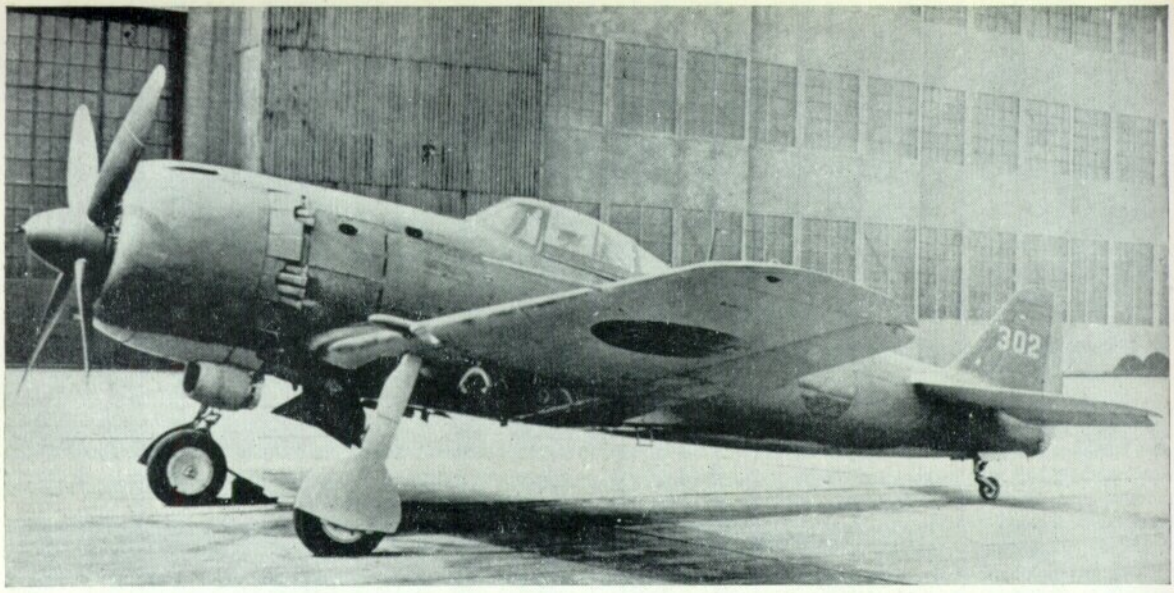
Tests progressed rapidly and smoothly without the usual teething troubles, the aircraft being enthusiastically received by the JAAF test pilots at the Tachikawa Air Arsenal. The two prototypes were quickly joined by 83 aircraft of a first service trial batch built at Ota between August 1943 and March 1944. Most of these aircraft differed from each other in minor details but, progressively, fuselage changes were incorporated to ease production and the shape and area of the fin and rudder were modified to improve control on take-off, as the aircraft suffered from a propeller-induced torque. During flight test operation a maximum speed of 388 m.p.h. was registered, slightly less than that originally specified but still exceeding the speed of any other Japanese fighter suitable for immediate production. Several aircraft of the initial service trial batch were assigned to an experimental Chutai (Squadron) which, manned by experienced pilots, conducted intensive service tests in Japan from October 1943 onwards. Some aircraft fitted experimentally with a ski undercarriage (the legs of which retracted in the normal wells with the skis lying flat under the wing roots) were tested in Hokkaido from December 1943 to February 1944. The ski installation increased the maximum weight of the aircraft, this in turn affecting negatively the manœuvrability and reducing the maximum speed by some 8 m.p.h. Following the various tests the Ki-84 was accepted for service operation by the JAAF and Nakajima initiated the mass production of the aircraft at its Ota plant under the service designation of Army Type 4 Model 1A *Hayate* (Ki-84-Ia).

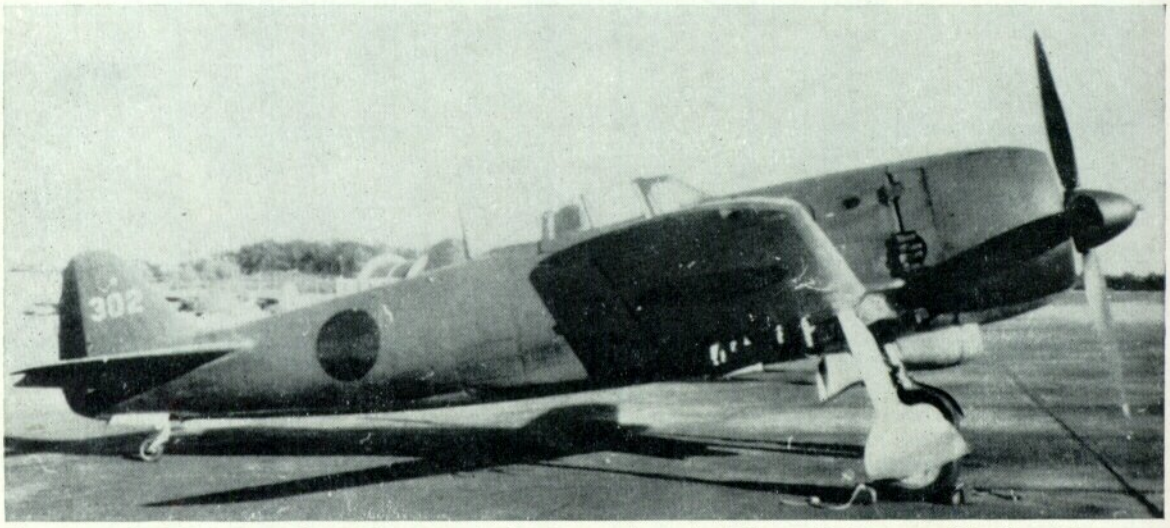
Prior to receiving the go-ahead for the mass production of the aircraft Nakajima had been asked to manufacture a second service trial batch of 42 aircraft, which were built between March and June 1944. Actually these aircraft were built parallel with the first production aircraft, which started to roll off the assembly lines in April 1944. The aircraft of the second service trial batch were essentially identical to production aircraft and were characterised by individual exhaust stacks to provide some thrust augmentation, thus increasing maximum speed by some 9 to 10 m.p.h., and by the use of two drop tanks, one under each wing outboard of the main wheels. Wing racks had been previously fitted to some aircraft of the first service trial batch and were used exclusively to carry bombs of up to 550 lb. Some of the aircraft of the second service trial batch were tested with wings of increased span and area to serve as development aircraft for the projected Ki-84N and Ki-84P.

Like the aircraft of the second service trial batch, the production Ki-84-Ias were powered either by a 1,800-h.p. Ha-45-11 or Ha-45-12 or by a 1,990-h.p. Ha-45-21 engine. They were built by Nakajima Hikoki K.K. at Ota, Gumma Prefecture, starting in April 1944; at Utsunomiya, Tochigi Prefecture, from May 1944 onwards; and by Mansyu Hikoki Seizo K.K. at Harbin, Manchuria, in the spring of 1945. Due to the pressing need for modern equipment to fight General MacArthur's return to the Philippines, most of the

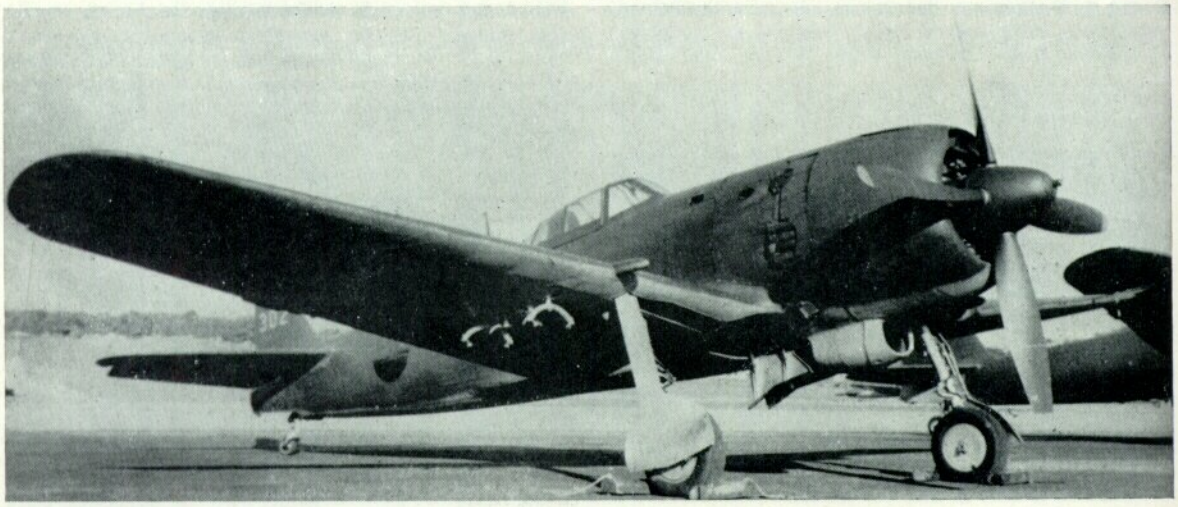
Ki-84s of the 73rd Sentai; apart from a tour in the Philippines, this unit was based almost exclusively in the Home Islands.
(Photo: Witold Liss)







Three views of a Ki-84-Ia in test livery. The cannons in the wings are the standard 20-mm. Ho-5 weapons, faired for trial purposes.
(Photos: Witold Liss, The Australian War Memorial, H. Nowarra)



initial production Ki-84-Ias were sent to Leyte where they served with the 1st, 11th, 22nd, 29th, 51st, 52nd, 71st, 72nd, 73rd and 200th Fighter Sentais. In combat the *Hayate* proved itself to be a redoubtable adversary when flown by experienced pilots due to its heavy armament, its exceptional protection by Japanese standards and its formidable performance: the Ki-84-Ia could outclimb and outmanœuvre all Allied fighters, and at low and medium altitude it was as fast as the P-51D and P-47D and faster than all other Allied aircraft. However, luckily for the Allies, the Japanese production workers lacked the skill of their colleagues assigned to experimental shops and the production Ki-84-Ia constantly suffered from failures of the fuel pressure and hydraulic systems and from weak landing gear struts, while the Ha-45 engine seldom developed its full theoretical power rating. In addition the lowering of the average experience of pilots and ground crews seriously affected the JAAF operations.

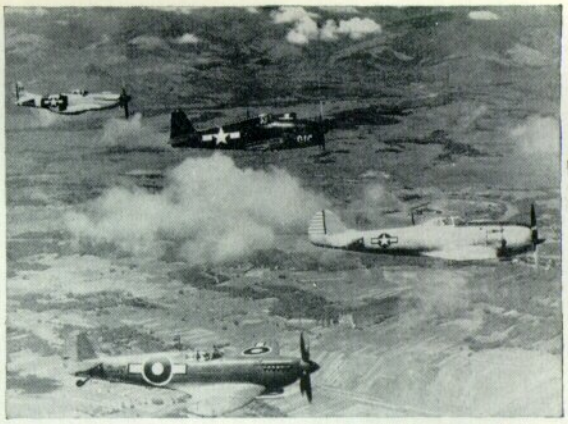
Following encounter of the Ki-84-Ia in substantial numbers, the Allied Technical Air Intelligence Unit (ATAIU) assigned the code-name "Frank" to this aircraft. This code-name had originally been assigned to a fictitious aircraft, the T.K.4, which the Allies believed under development in Japan. The T.K.4 failing to materialise, Colonel Frank McCoy, Commanding Officer of the ATAIU, decided to name the redoubtable new foe after himself!

THE GALE DESCRIBED

The Nakajima Ki-84-Ia *Hayate* (Gale) was a single-seat, low-wing cantilever monoplane of conventional design.

Fuselage: Light alloy semi-monocoque structure of oval section with a flush riveted, stressed-skin covering built in three sections. The engine mounting and cowling, incorporating oil-cooler, intakes for the carburettor and supercharger, and the machine gun barrels formed the forward section. The fuselage centre section incorporated two firewalls between which was mounted a 42·2 U.S. gallon water-methanol tank, the cockpit with 65-mm. armoured windscreen and pilot's 13-mm. head and back armour plate, the three-part canopy with sliding central section and the wing centre section. In the rear fuselage section was installed the main fuel tank and the radio equipment.

Wings: All metal single-spar with stressed-skin light alloy covering built in three sections, centre and outer panels. The fabric-covered ailerons were attached to the fourteenth and twenty-fourth ribs by means of self-centring bearings located at both ends of the ailerons. The aileron control rod was attached at a centre point. The hydraulically operated Fowler-type flaps had a maximum deflection of 35°. Provision was made in the wings for two cannons, two main wing fuel tanks and two auxiliary leading-edge tanks, wheel wells and underwing racks, one outboard of each cannon.



Unusual photograph of a captured Ki-84-Ia escorted by a Seafire III (NN 610) of the British Pacific Fleet, an F6F-5 Hellcat of the U.S. Navy, and a P-51D of the U.S.A.A.F.
(Photo: R.A.A.F.)

Tail: The rudder, like the other control surfaces, was of metal construction with fabric covering. The horizontal stabiliser was built well ahead of the vertical surfaces.

Undercarriage: Fully retractable hydraulically operated conventional landing gear. The main gear retracted inboard and horizontally into the wings and was fully covered by flush-fitting doors. The brakes were hydraulically operated. The non-steerable tail wheel retracted into the fuselage and was also covered by a flush-fitting door.

Armament: Two 12·7-mm. Ho-103 synchronised machine guns with 350 r.p.g. in the forward fuselage upper decking and two 20-mm. Ho-5 cannons with 150 r.p.g. in the wings outboard of the undercarriage. Underwing racks for two bombs of up to 550 lb. were provided.

Engine: One 18-cylinder radial Army Type 4 Model 11 or 12 (Nakajima Ha-45-11 or Ha-45-12) developing 1,800 h.p. at 2,900 r.p.m. on take-off, 1,650 h.p. at 6,560 ft. and 1,460 h.p. at 18,700 ft. Late production Ki-84-Ias received an Army Type 4 Model 21 (Ha-45-21) rated at 1,990 h.p. at 3,000 r.p.m. on take-off, 1,875 h.p. at 5,900 ft. and 1,695 h.p. at 20,000 ft. Either of these engines drove a 10 ft. or 10·2 ft. four-blade electric constant-speed propeller.

Ground crew pose by a Ki-84 shortly after capture.
(Photo: R. Ward collection)

Captured Ki-106, with a Mitsubishi J8M1 Shusui *on the right, parked behind a row of F6F-5s.* (Photo: via the author)

Fuel System: According to Japanese documents the maximum internal capacity was 737 litres (195 U.S. gallons) in one fuselage fuel tank and four wing tanks. However, U.S. flight test reports quoted the following capacity: rear fuselage tank 57·3 U.S. gallons, port and starboard wing tanks each 45·65 U.S. gallons and two outboard wing leading-edge tanks each 17·7 U.S. gallons, or a total capacity of 184 U.S. gallons (700 litres). A 53 U.S. gallon (200 litre) drop-tank could be carried under each wing.

THE GALE GROWS STRONGER

Whilst the *Hayate* was enthusiastically received by operational pilots Nakajima set about improving overall performance of the aircraft and correcting the deficiencies which had appeared during operations in the Philippines. Emphasis had been placed during the design phase on ease of production and the manufacture of the Ki-84 required respectively 44 per cent and 42 per cent less tooling than the Ki-43 and Ki-44. However, this simplification was not sufficient to offset the drop in industrial skill standards brought about by the drafting into JAAF service of experienced workers and the accelerated rate of production imposed by the Japanese Ministry of Munitions. Consequently operational *Hayates* seldom matched the performances of the service trial aircraft and often proved unreliable in the exacting combat environment.

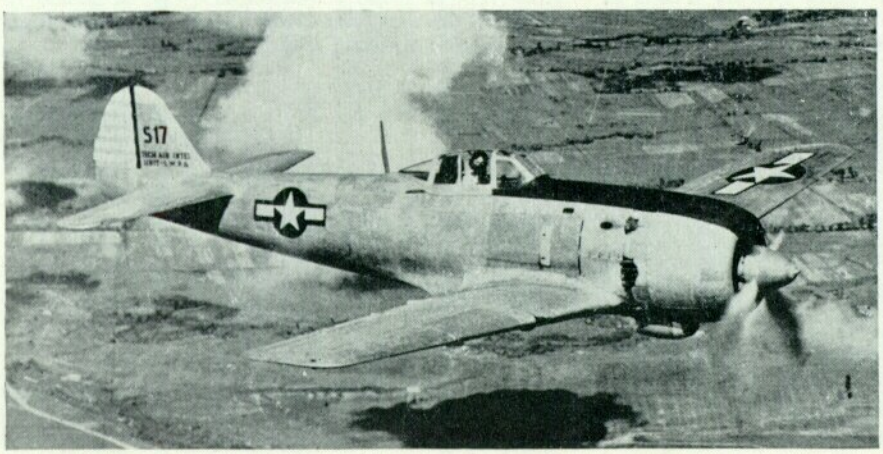
To improve the performance and reliability of the powerplant the Ki-84 was fitted with various models of the Ha-45, culminating in the Model 23 (Ha-45-23), a modification of the more common Ha-45-21, fitted with a low-pressure fuel injection system. But there the main difficulty lay in the attention shown by the U.S. 20th Air Force to Nakajima's engine plant at Musashi, the situation being partially corrected by the transfer of Ha-45 production to an underground plant at Asakawa and the opening of a new engine plant at Hamamatsu.

During its mass production period, during which over 3,400 aircraft were built in less than eighteen months by two Nakajima plants and the Harbin plant of Mansyu, the Ki-84 was only slightly modified. The Army Type 4 Model 1A was followed on the assembly lines by the Model 1B (Ki-84-Ib) in which the synchronised machine guns were replaced by two Ho-5 cannons, thus giving the aircraft a fixed armament of four 20-mm. cannons; while a few Model 1C (Ki-84-Ic) were built and armed with two synchronised 20-mm. Ho-5 cannons and two wing-mounted 30-mm. Ho-105 cannons for operation against the B-29. In early 1945, Nakajima introduced a new version with modified wingtips and a wooden rear fuselage, all wood work being done in a shadow factory at Tanuma. Most of these aircraft were powered by a 1,990-h.p. Ha-45-21, some receiving the improved Ha-45-25 of similar power, whereas late production aircraft received the 2,000-h.p. Ha-45-23 with low-pressure fuel injection; the fixed armament consisted of four 20-mm. cannons or two 20-mm. cannons and two 30-mm. cannons. In Nakajima's nomenclature these improved aircraft, in which maximum speed had been raised to 416 m.p.h., were known as Ki-84-II *Hayate-Kai* (Gale modified) but the JAAF headquarters and the Ministry of Munitions never adopted this designation, the aircraft being also designated Ki-84-Ib and Ki-84-Ic in service operation.

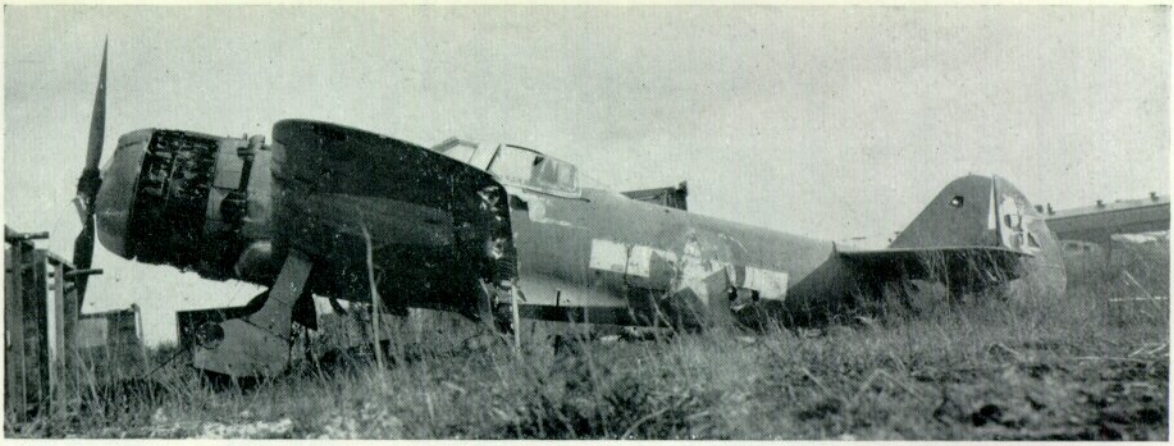
A two-seat, dual-control trainer version was designed by Nakajima's engineers but was not built. However, several standard Ki-84-Is were modified in the field by removal of the radio equipment and back armour plate and installation of a jump seat behind the pilot's seat. Lacking dual-control equipment they were only used to familiarise new pilots with the aircraft's idiosyncrasies.

A high-altitude fighter version, the Ki-84-III, using a standard Ki-84-I airframe suitably modified to mount a Ha-45Ru engine with a turbo-supercharger mounted in the fuselage belly, was under development but none had been completed when the war ended.

Following large-scale operations in the Philippines, as reported earlier, Ki-84s rapidly replaced Ki-43s in nine additional Sentais and Ki-44s in two other Sentais; whilst two new Sentais, the 111th and 200th, were activated with Ki-84s on strength. *Hayates* were used for long-range penetration missions, fighter sweeps, strafing, interception and dive-bombing operations with considerable success, being as feared by Allied pilots as they were praised by their own pilots. Few *Hayates* were assigned to the China-Burma-East Indies theatre of operation, but they were



A Hayate *under test by Allied Intelligence in Australia.* (Photo: R.A.A.F.)



End of a great hope; a prototype Ki-106 in an advanced state of decay. (Photo: via the author)

extremely active over Okinawa where they obtained some remarkable results in day and night sweeps over American airfields.

RIDING A GALE

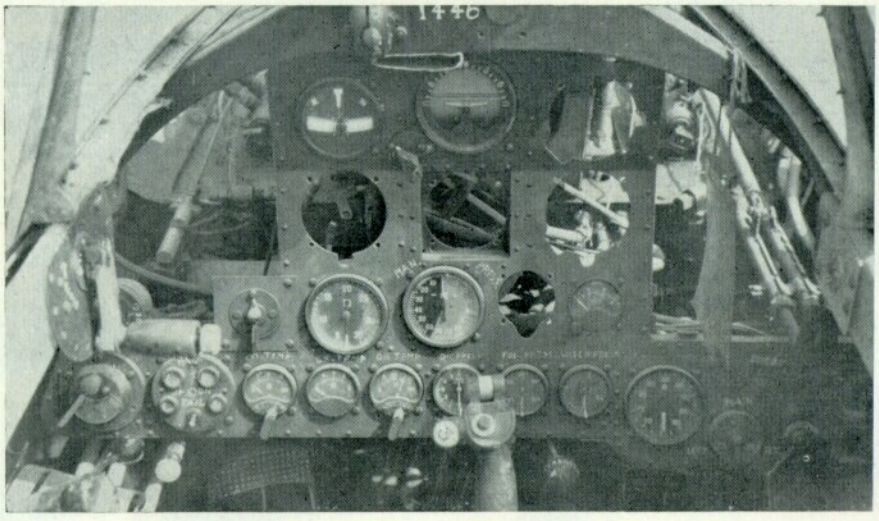
The general layout of the *Hayate's* cockpit was good and quite sophisticated by Japanese standards; good protection was given to the pilot by the head and back armour plate and armoured windscreen, but no emergency release of the canopy or fire extinguishing equipment was provided.

The aircraft handled rather poorly in taxiing due to the inadequate brake action. The take-off characteristics were good, with a comparatively short ground run and negligible torque effect if rated power was applied gradually, but full right rudder and some use of the brakes was necessary when power was applied abruptly. The aircraft became airborne at 95 m.p.h. IAS and rate of climb was excellent, an altitude of 10,000 ft. being attained in 2·6 minutes. In general, the handling and control characteristics, though inferior to those of previous JAAF fighters were definitively superior to those of contemporary Allied aircraft. Control-feel was good; rudder and ailerons were light but rudder control was extremely sensitive at 300 m.p.h. IAS, while elevator forces, although heavier than those for the rudder and ailerons, were not objectionable. Flight-adjustable trim was provided for the elevator only and the lack of rudder trim, which would have improved the aircraft as a gun platform, was deplored by many pilots. The *Hayate's* stall characteristics were normal and stall warning occurred soon enough to prevent stall if recovery procedure was initiated at once.

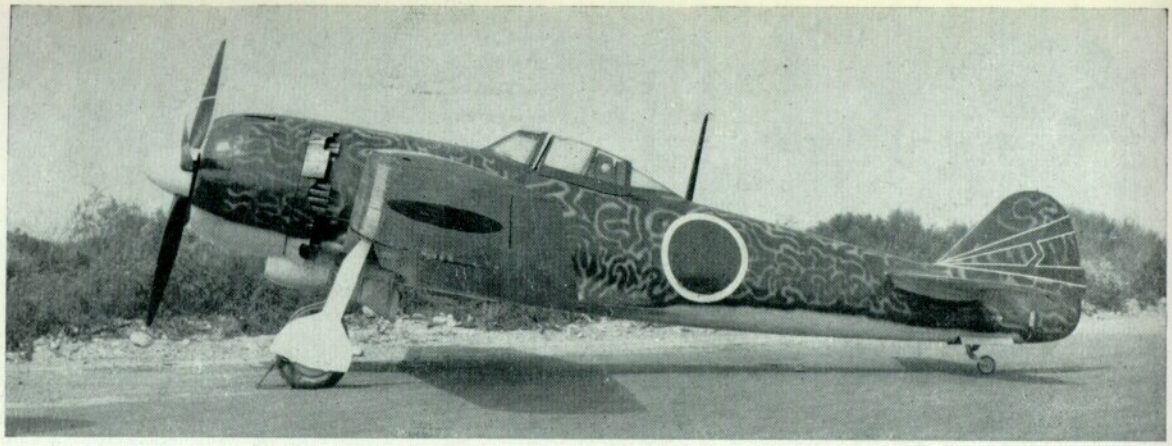
The *Hayate* handled well on approach and landing, undercarriage extension being performed at speeds below 160 m.p.h. AS and full flaps being applied at 130 m.p.h. IAS the aircraft touching down at 92 m.p.h. The ground roll was short but three-point forward vision was poor.

The aircraft was extremely popular with its pilots who praised in particular its good stability which rendered it suitable for night operations. Allied pilots who test-flew the aircraft were much impressed with it and pilots of the U.S. Materiel Command at Wright Field, Ohio, concluded their reports as follows:

> "It is believed that the 'Frank-1' is a fighter aircraft with excellent manœuvrability and handling qualities and good rate of climb for its type. The light power loading and control forces are admirable, although its lack of pilot protection and short range (*by U.S. standards—Author*) leave much to be desired in the light of present fighter standards."



Partially dismantled Hayate *cockpit; note the gaps left by the removal of the two Ho-103 machine guns.*
(Photo: via the author)



Two views of the Ki-84-Ia at the Air Museum, Ontario, California. The paint scheme, though pleasing, is not accurate; the tail marking does, however, resemble that of the 52nd Sentai fairly closely. (Photos: Air Museum)

THE GALE SPREADS AND RECEDES

With the war brought to the doorstep of their homeland, Nakajima engineers concentrated their development efforts on the Ki-84 towards (1) improving its characteristics and performance as a high-altitude interceptor, and (2) adapting the aircraft for manufacture from non-strategic materials available in Japan. A brief description of these various projects and their status at the end of the war is given below.

Ki-84N: Projected high-altitude interceptor powered by a 2,500-h.p. eighteen-cylinder two-row radial Nakajima Ha-44-13 (Ha-219 under the old JAAF designation system). Wing area increased from 226 sq. ft. to 242·19 sq. ft. This aircraft was in the initial design stage when Japan capitulated but it was planned to mass produce it under the Ki-117 designation.

Ki-84P: Project in the initial design phase at war's end. Nakajima Ha-44-13 rated at 2,500 h.p. for take-off. Wing area increased by 37·72 sq. ft. to 263·72 sq. ft.

Ki-84R: Less ambitious version using the standard Ki-84-I airframe adapted to mount a 2,000-h.p. Nakajima Ha-45-44 with a mechanically-driven two-stage three-speed supercharger. At the time of Japan's final defeat a prototype was eighty per cent complete.

Ki-106: To compensate for the critical shortage of light alloy, Tachikawa Hikoki K.K. redesigned the entire *Hayate's* structure for wooden construction. In 1945 three prototypes were built under subcontract by Ohji Koku K.K., employing a large percentage of unskilled labour. By applying a thick coat of lacquer to the plywood skin a smooth finish was obtained at the expense of some 600 lb. increase in loaded weight. The standard 1,990-h.p. Nakajima Ha-45-21 was retained and armament of the first prototype, flown in July 1945, comprised four 20-mm. cannons. A second aircraft, with armament reduced to two 20-mm. cannons to save some weight, flew during the last week of the war. The Ki-106 was liked by its pilots but the Ministry of Munitions ordered Tachikawa to study appropriate means of reducing weight prior to allowing the mass production of the aircraft.

Ki-113: Designed in the autumn of 1944 by Nakajima the Ki-113 was partially built of steel: carbon steel for the cockpit section, ribs and bulkheads and steel sheet skinning. A prototype, powered by 1,990-h.p. Nakajima Ha-45-21 and armed with four 20-mm. cannon, was completed in early 1945 but not flown as it was decidedly overweight.

Ki-116: Following the successful adaptation of the Kawasaki Ki-61-II to take the Mitsubishi Ha-112-II radial engine, the JAAF instructed Mansyu to modify its fourth aircraft by mounting a 1,500-h.p. Ha-33-62 (Ha-112-II) driving a three-blade propeller taken from a Mitsubishi Ki-46-III. The conversion was very successful, a reduction of 1,000 lb. in empty weight being registered, and the aircraft was undergoing intensive flight trials when Japan capitulated.

Ki-117: Designation applying to the projected production version of the Ki-84N.

While these developments were taking place the JAAF was forced to curtail its operations due to the critical shortage of aviation fuel, and most JAAF units were kept in reserve for the anticipated final assault on Japan. However, the 47th Sentai at Narumatsu, the 72nd Sentai at Tokorozawa, the 111th and 112th Sentais at Omachi, and the 246th Sentai at Taisho, all equipped with *Hayates*, were intensively used against aircraft of the U.S. 20th Air Force and Third Fleet and the British Pacific Fleet. Unfortun-

Key to tail emblems illustrated on opposite page:

1. **1st Group, 1st Squadron.**
2. **1st Group, 2nd Squadron.**
3. **1st Group, 3rd Squadron.**
4. **14th Group, 1st Squadron.**
5. **51st Group, 1st Squadron (2nd Sqn. red, 3rd Sqn. yellow).**
6. **13th Group.**
7. **52nd Group, 1st Squadron.**
8. **52nd Group, 3rd Squadron (2nd Sqn. red).**
9. **73rd Group, Headquarters Flight.**
10. **29th Group (1st Sqn. white, 2nd Sqn. red, 3rd Sqn. yellow).**
11. **74th Group.**
12. **72nd Group, 1st Squadron.**
13. **72nd Group, 2nd Squadron.**
14. **72nd Group, 3rd Squadron.**

Note that in the interests of clarity the terms "Group" and "Squadron" have been substituted in the captions to the colour illustrations opposite for the J.A.A.F. unit styles of "Sentai" and "Chutai" respectively. The term "Headquarters Flight" has been substituted for the Japanese "Hombu Sentai".

Ki-84-I, 104th Group, 1st Squadron, Manchuria, 1945.
40
1
2
Ki-84-I, 102nd Group, 2nd Squadron, Okinawa, 1944.
3
Ki-84-I, 11th Group, 3rd Squadron.
47
4
5
Ki-84-I, 47th (Home Defence) Group, 1st Squadron, Narumatsu, Japan, 1945.
22
6
Ki-84-I, 21st Air Brigade, Leyte, 1944.
7
Ki-84-I, 73rd Group, 1st Squadron.
325
8
9
17
10
Ki-84-I, 85th Group, 3rd Squadron.
加
Ki-84-I, 29th Group, Headquarters Flight, Formosa, 1945.
11
12
10
Ki-84-I, 24th Independent Fighter Squadron, Sumatra, 1945.
91
13
14
23
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ately for the Japanese these units were outnumbered and the atomic attacks on Hiroshima and Nagasaki only accelerated a foregone defeat.

A surviving Ki-84-Ia, which had been tested at the end of the war by the Air Materiel Command, was rebuilt in 1963 by Garret-AiResearch Aviation Service at Los Angeles International Airport. This aircraft, carrying the FAA experimental registration *N3385G*, was flown again on 25th June 1963 by the W.W.II and Korean war fighter ace, Colonel Walker M. Mahurin, U.S.A.F. Reserve, and is now maintained in flying condition by the staff of the California Air Museum at Ontario, California.

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PRODUCTION

A total of 3,482 *Hayates* were built by Nakajima Hikoki K.K. as follows:

Ota plant ...	2	prototypes (April–June 1943).
	83	service trial aircraft (August 1943–March 1944).
	42	service trial aircraft (March 1944–June 1944).
Ota and Utsonomiya plants ...	3,355	production aircraft (April 1944–August 1945).
	3,482	

According to the Ministry of Munitions 3,577 Ki-84s were built which would place the production by Mansyu Hikoki Seizo K.K. at 95 aircraft. Of the 3,577 aircraft built the JAAF accepted delivery of 3,470, with 107 aircraft being retained by their manufacturers for tests and modifications.

SERVICE DEPLOYMENT OF THE Ki-84-I "HAYATE"

Unit	Period	Theatres of Operation
Sentai		
1st	Autumn 1944–Aug. 1945	Philippines, Japan.
11th	Second half of 1944	Philippines.
13th	Feb. 1945–Aug. 1945	Indo-China, Thailand.
20th	Feb. 1945–Aug. 1945	Formosa.
22nd	Mar. 1944–Aug. 1945	Japan, China, Philippines, Korea.
25th	Mar. 1945–Aug. 1945	China.
29th	Nov. 1944–Aug. 1945	Philippines, Japan, Formosa.
47th	Dec. 1944–Aug. 1945	Japan.
50th	Late 1944–Aug. 1945	Burma, Thailand, Indo-China, Formosa.
51st	June 1944–Aug. 1945	Japan, Philippines, Japan.
52nd	June 1944–Aug. 1945	Japan, Philippines, Japan.
64th	Converting from Ki-43 at war's end in Thailand.	
71st	June 1944–Aug. 1945	Japan, Philippines, Japan.
72nd	June 1944–Aug. 1945	Japan, Philippines, Japan.
73rd	June 1944–Aug. 1945	Japan, Philippines, Japan.
85th	Sept. 1944–Aug. 1945	China, Korea.
101st	Sept. 1944–Aug. 1945	Okinawa, Shikoku.
102nd	Sept. 1944–Aug. 1945	Okinawa, Shikoku.
103rd	Sept. 1944–Aug. 1945	South-west Islands, Shikoku.
104th	Nov. 1944–Aug. 1945	Manchuria.
111th	1945	Japan.
112th	1945	Japan.
200th	Second half of 1944	Philippines.
246th	1945	Japan.
24th Dokuritsu Dai Shijugo Chutai	Jan. 1945–Aug. 1945	Sumatra, Formosa.

SPECIFICATIONS

	Ki-84-Ia		Ki-84-II	Ki-106	Ki-113	Ki-116
	JAAF Official (Early Production)	U.S. Test Results (Late Production)				
Span...	37 ft. $\frac{7}{8}$ in.	37·1 ft.	37 ft. $\frac{7}{8}$ in.	37 ft. $\frac{7}{8}$ in.	37 ft. $\frac{7}{8}$ in.	37 ft. $\frac{7}{8}$ in.
Length	32 ft. 6 $\frac{1}{16}$ in.	32·32 ft.	32 ft. 6 $\frac{1}{16}$ in.	32 ft. 7 $\frac{1}{16}$ in.	32 ft. 6 $\frac{1}{16}$ in.	—
Height	11 ft. 1 in.	11·17 ft.	11 ft. 1 in.	11 ft. 9 in.	11 ft. 1 in.	—
Wing area	226 sq. ft.	226 sq. ft.	226 sq. ft.	226 sq. ft.	226 sq. ft.	226 sq. ft.
Empty weight ...	5,948 lb.	—	—	—	6,349 lb.	4,850–5,070 lb.
Loaded weight ...	8,576 lb.	7,940 lb.	8,495 lb.	—	8,708 lb.	—
Maximum weight ...	—	9,194 lb.	—	—	—	—
Wing loading* ...	37·9 lb./sq. ft.	35·1 lb./sq. ft.	37·6 lb./sq. ft.	—	38·5 lb./sq. ft.	—
Power loading* ...	4·8 lb./h.p.	4·0 lb./h.p.	4·2 lb./h.p.	—	4·4 lb./h.p.	—
Fuel capacity:						
Internal	195 U.S. gals.	184 U.S. gals.	195 U.S. gals.	—	195 U.S. gals.	—
Drop tanks ...	+106 U.S. gals.	+174 U.S. gals.	+106 U.S. gals.	—	+106 U.S. gals.	—
Engine	Ha-45-11	Ha-45-21	Ha-45-23	Ha-45-21	Ha-45-21	Ha-33-62
Take-off rating ...	1,800 h.p. at 2,900 r.p.m.	1,970 h.p. at 3,000 r.p.m.	2,000 h.p. at 3,000 r.p.m.	1,990 h.p. at 3,000 r.p.m.	1,990 h.p. at 3,000 r.p.m.	1,500 h.p.
War emergency rating	1,650 h.p. at 6,096 ft.	2,050 h.p. at 2,500 ft.	—	1,860 h.p. at 6,096 ft.	1,860 h.p. at 6,096 ft.	—
Maximum speed ...	—	363 m.p.h. at S.L.	—	—	—	—
	388 m.p.h. at 19,685 ft.	427 m.p.h. at 20,000 ft.	416 m.p.h.	385 m.p.h. at 20,100 ft.	385 m.p.h. at 21,325 ft.	385 m.p.h.
	—	360 m.p.h. at 35,000 ft.	—	—	—	—
Cruise speed ...	237 m.p.h. at 13,125 ft.	254 m.p.h. at 1,500 ft.	—	310 m.p.h. at 20,100 ft.	—	—
Climbing speed ...	16,405 ft. in 5 min. 54 sec.	4,275 ft./min.	—	16,405 ft. in 5 min.	16,405 ft. in 6 min. 54 sec.	—
Service ceiling ...	36,100 ft.	38,000 ft.	—	36,100 ft.	33,150 ft.	—
Range norm./max.	1,085 m.	780 m. at 254 m.p.h.	—	500 m. +1·5 hr. Combat	500 m. +0·5 hr. Combat	—
	1,550 m.	1,845 m. at 173 m.p.h.	—	—	—	—
Armament	2 × 12·7-mm. Ho-103 (350 r.p.g.)	2 × 12·7-mm. Ho-103 (350 r.p.g.)	4 × 20-mm. Ho-5	4 × 20-mm. Ho-5	4 × 20-mm. Ho-5	2 × 12·7 mm. Ho-103
	2 × 20-mm. Ho-5 (150 r.p.g.)	2 × 20-mm. Ho-5 (150 r.p.g.)	—	—	—	2 × 20-mm. Ho-5
	2 × 66-lb. or 550-lb. bombs	2 × 440-lb. bombs	2 × 550-lb. bombs	—	—	—

**At normal loaded weight.*

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